



Mitra 24-8-11-6
Confirmation No. 6213

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

5 Applicant(s): Mitra et al.
Docket No: 24-8-11-6
Serial No.: 10/614,738
Filing Date: July 7, 2003
Group: 2617
10 Examiner: Allahyar Kasraian

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Signature: *Bobbie J. Blue* Date: August 3, 2009

Title: Techniques for Network Traffic Engineering

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
20 P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

25 Applicants hereby appeal the final rejection dated March 3, 2009, of claims 1-9, 13, 16, and 21-24 of the above-identified patent application.

REAL PARTY IN INTEREST

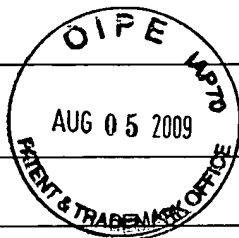
30 The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded on November 5, 2003 in the United States Patent and Trademark Office at Reel 014670, Frame 0556. The assignee, Lucent Technologies Inc., is the real party in interest.

RELATED APPEALS AND INTERFERENCES

35 There are no related appeals or interferences.

STATUS OF CLAIMS

The present application was filed on July 7, 2003 with claims 1 through 23. Claim 24 was added in the Amendment and Response to Office Action dated December 16,



Electronic Acknowledgement Receipt

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International Application Number:	
Confirmation Number:	6213
Title of Invention:	<div>COPY</div> Techniques for network traffic engineering
First Named Inventor/Applicant Name:	Debasis Mitra
Customer Number:	46303
Filer:	Kevin M. Mason
Filer Authorized By:	
Attorney Docket Number:	Mitra 24-8-11-6
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Notice of Appeal Filed	1200-1041_NoticeofAppeal_6-2-09.pdf	118102 8376c1632518a1d30f94998ce2c1066b6d7f08c7	no	1
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Warnings:

Information:

2	Fee Worksheet (PTO-875)	fee-info.pdf	29703 a634c694f263c3ae4e7ad36b971d8c58dbcd7b5f	no	2
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

2008. Claims 1 through 24 are presently pending in the above-identified patent application.

Claims 1-4, 21 and 22 are rejected under 35 U.S.C. §103(a) as being unpatentable over Devi (United States Patent Publication No. 2003/0147400; hereinafter Devi), in view of Aukia et al. (United States Patent Number 6,594,268; hereinafter Aukia). Claims 5, 7-9, 13 and 16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Devi in view of Aukia, and further in view of Szviatovszki et al. (United States Patent Number 6,956,821; hereinafter Szviatovszki), and claim 23 is rejected under 35 U.S.C. §103(a) as being unpatentable over Szviatovszki and in view of Shabtay et al. (United States Patent Number 6,895,441; hereinafter Shabtay). The Examiner indicated that claims 10-12, 14, 15, and 17-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

Claims 1, 7, and 21-23 are being appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a method for traffic engineering in a network-based communication system (page 5, line 12, to page 6, line 12), the method comprising the steps of:

determining, in response to a request, whether any path of a plurality of predetermined paths (FIG. 1: 115) between a source node (FIG. 1: 120) and a destination node (FIG. 1: 140) meets at least one requirement corresponding to the request (page 5, line 28, to page 6, line 12), wherein the plurality of predetermined paths are determined by substantially maximizing a carried demand on a network (page 10, lines 1-20) using at least traffic demand estimates and network topology information (page 10, lines 2-4; and FIG. 3: 320 and FIG. 4: 410), and by performing routing for the substantially maximized carried demand (page 10, lines 15-20; and FIG. 4: 420); and

selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting

the at least one requirement is found (page 3, line 24, to page 4, line 20; page 5, line 28, to page 6, line 10; and page 17, line 22, to page 18, line 14).

Claim 7 requires wherein:

the network topology comprises nodes interconnected through edges (page 9,
5 lines 10-13);

the request is made by a source node (FIG. 1: 120; page 5, line 32, to page 6, line
10);

the method further comprises the steps of:

determining whether a designed load between the source node and a destination
10 node (FIG. 1: 140) is greater than a measured load between the source and destination nodes
(page 18, lines 15-26);

when the designed load between the source node and the destination node is
greater than a measured load between the source node and the destination node, pruning edges
that do not have a first available bandwidth from the network, thereby creating a first pruned
15 network (page 18, line 9, to page 19, line 12); and

when the designed load between the source and a destination is not greater than a
measured load between the source and destination, pruning edges that do not have a second
available bandwidth from the network, thereby creating a first pruned network (page 18, line 9,
to page 19, line 12).

20 Independent claim 21 is directed to an apparatus for traffic engineering for in a
network-based communication system (page 5, line 12, to page 6, line 12), the apparatus
comprising:

a memory (FIG. 1: 112); and

at least one processor (FIG. 1: 111), coupled to the memory;

25 the apparatus operative:

to determine, in response to a request, whether any path of a plurality of
predetermined paths (FIG. 1: 115) between a source node (FIG. 1: 120) and a destination node
(FIG. 1: 140) meets at least one requirement corresponding to the request (page 5, line 28, to
page 6, line 12), wherein the plurality of predetermined paths are determined by substantially
30 maximizing carried demand on a network (page 10, lines 1-20) using at least traffic demand

estimates and network topology information (page 10, lines 2-4; and FIG. 3: 320 and FIG. 4: 410), and by performing routing for the substantially maximized carried demand (page 10, lines 15-20; and FIG. 4: 420); and

to select one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting the at least one requirement is found (page 3, line 24, to page 4, line 20; page 5, line 28, to page 6, line 10; and page 17, line 22, to page 18, line 14).

Independent claim 22 is directed to an article of manufacture for traffic engineering in a network-based communication system (page 5, line 12, to page 6, line 12), the article of manufacture comprising:

a machine readable medium containing one or more programs which when executed implement the steps of:

determining, in response to a request, whether any path of a plurality of predetermined paths (FIG. 1: 115) between a source node (FIG. 1: 120) and a destination node (FIG. 1: 140) meets at least one requirement corresponding to the request (page 5, line 28, to page 6, line 12), wherein the plurality of predetermined paths are determined by substantially maximizing carried demand on a network (page 10, lines 1-20) using at least traffic demand estimates, and network topology information (page 10, lines 2-4; and FIG. 3: 320 and FIG. 4: 410), and by performing routing for the substantially maximized demand (page 10, lines 15-20; and FIG. 4: 420); and

selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting the at least one requirement is found (page 3, line 24, to page 4, line 20; page 5, line 28, to page 6, line 10; and page 17, line 22, to page 18, line 14).

Independent claim 23 is directed to a method for traffic engineering for a network-based communication system (page 5, line 12, to page 6, line 12) comprising a network having nodes interconnected through edges (page 9, lines 9-30), and wherein a source node (FIG. 1: 120) requests a connection to a destination node (FIG. 1: 140), the method comprising the steps of:

determining a first shortest path between the source node and destination node
(page 4, lines 9-11);

pruning edges not having a first available bandwidth from the network, thereby
creating a first pruned network (page 4, lines 11-12);

5 computing a second shortest path between the source node and the destination
node using the first pruned network (page 4, lines 12-14);

if a length of the second shortest path is equivalent to a length of the first shortest
path, attempting to create a connection on the second shortest path page 4, lines 14-15); and

10 if a length of the second shortest path is not equivalent to a length of the first
shortest path (page 4, lines 15-17), performing the following steps:

pruning edges not having a second available bandwidth from the
first pruned network, thereby creating a second pruned network (page 4, lines 17-
18);

15 computing a third shortest path between the source node and
destination node using the second pruned network (page 4, lines 18-20); and

attempting to create a connection on the third shortest path (page 4,
line 20).

STATEMENT OF GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

20 Claims 1-4, 21 and 22 are rejected under 35 U.S.C. §103(a) as being unpatentable
over Devi in view of Aukia, claims 5, 7-9, 13 and 16 are rejected under 35 U.S.C. §103(a) as
being unpatentable over Devi in view of Aukia, and further in view of Szviatovszki, and claim
23 is rejected under 35 U.S.C. §103(a) as being unpatentable over Szviatovszki and in view of
Shabtay.

ARGUMENT

Independent Claims 1, 21 and 22

25 Independent claims 1, 21, and 22 were rejected under 35 U.S.C. §103(a) as being
unpatentable over Devi, in view of Aukia et al. Regarding claim 1, the Examiner asserts that
30 Devi discloses determining, in response to a request, whether any path of a plurality of

predetermined paths between a source node and a destination node meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing a carried demand on a network using at least traffic demand estimates, network topology information, and by performing routing for the substantially maximized carried demand (FIGS. 1 and 2; paragraphs [0004]-[0005], [0014], [0026], and [0028]-[0029]). The Examiner previously asserted that measuring current load at a source (or at a router between source and destination) is well-known and required for routing estimation which is inherent in Devi's method, and Aukia clearly discloses the combination of the traffic demand estimation, network topology information, and current load measurement (col. 21, lines 23-51; and col. 10, lines 24-33).

In the Response to Arguments section of the final Office Action, the Examiner asserts that Devi discloses selecting one of said predetermined paths between a source node and a destination node based on a current load measurement (paragraphs [0018]-[0019] and [0047]-[0049]).

Appellants note that independent claims 1, 21, and 22 require determining, in response to a request, whether any path of *a plurality of predetermined paths between a source node and a destination node* meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing a carried demand on a network using at least traffic demand estimates and network topology information, and by performing routing for the substantially maximized carried demand; and *selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at a source node*, if a given path meeting the at least one requirement is found. Support for this limitation can be found on page 3, line 24, to page 4, line 20; page 5, line 28, to page 6, line 10; and page 17, line 22, to page 18, line 14, of the originally filed disclosure.

Appellants note that Devi does *not* disclose or suggest *selecting one of said predetermined paths between a source node and a destination node based on a current load measurement, wherein said current load measurement is measured at a source node*. Appellants also note that, as the Examiner acknowledges, Aukia discloses a technique similar to OSPF and teaches that each node in the network determines, in a distributed manner, *the path for the*

source-destination pair that traverses the node; Appellants are not aware of any teaching by OSPF that a current load measured at a source node can be used to select a predetermined path or to select a path from a source node to a destination node and note that the Examiner has not provided any reference that discloses such a teaching. (See, Abstract and Summary of the Invention.) Aukia does not use a *current load measurement that is measured at a source node* to select a predetermined path or to select a path that starts at a source node and ends at a destination node. Neither Devi nor Aukia, alone or in combination, disclose or suggest selecting a predetermined path (between a source node and a destination node) based on a current load measurement measured at a source node.

In the Response to Arguments section of the final Office Action, the Examiner asserts that Applicant's argument presented above relies on a feature, i.e., OSPF, that is not recited in the claims. Appellants note, to the contrary, that the feature being relied upon is recited in the claims, i.e., the feature of selecting one of said predetermined paths between a source node and a destination node based on a current load measurement, wherein said current load measurement is measured at a source node. Since Aukia teaches OSPF and since OSPF is well known to require that each node in the network determines, in a distributed manner, the path for the source-destination pair that traverses the node, neither Aukia nor OSPF, alone or in combination, disclose or suggest selecting a predetermined path, disclose or suggest a predetermined path between a source node and a destination node, nor disclose or suggest selecting a predetermined path between a source node and a destination node.

Thus, even as combined in the manner suggested by the Examiner, Devi and Aukia *do not teach every element of the independent claims*. Furthermore, based on the KSR considerations discussed hereinafter, the combination/modification suggested by the Examiner is not appropriate.

KSR Considerations

An Examiner must establish "an apparent reason to combine ... known elements." *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 USPQ2d 1385 (2007). Here, the Examiner merely states that it would have been obvious to incorporate the well-known technique of measuring a current load at a router (or source node) which is responsible to forward and/or send packets to the destination as taught by Aukia to the optimization method based on demand

estimate and network topology information as disclosed by Devi for the purpose of maximizing revenue based on current and past history of data traffic of a router.

Appellants, however, are claiming a new technique for traffic engineering in a network-based communication system wherein a *predetermined path (between a source node and a destination node)* is selected from a plurality of predetermined paths based on a current load measurement measured at a source node. There is no suggestion in Devi or in Aukia, alone or in combination, to select a predetermined path (between a source node and a destination node) from a plurality of predetermined paths based on a current load measurement measured at a source node.

Furthermore, Aukia's teaching to have *each node along a path compute its own route to a next node teaches away* from the present invention's. The KSR Court discussed in some detail United States v. Adams, 383 U.S. 39 (1966), stating in part that in that case, "[t]he Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." (KSR Opinion at p. 12). Thus, there is no reason to make the asserted combination/modification.

Thus, Devi and Aukia, alone or in combination, do not disclose or suggest determining, in response to a request, whether any path of a plurality of predetermined paths between a source node and a destination node meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing a carried demand on a network using at least traffic demand estimates and network topology information, and by performing routing for the substantially maximized carried demand; and selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at a source node, if a given path meeting the at least one requirement is found, as required by independent claims 1, 21, and 22.

Independent Claim 23

Independent claim 23 was rejected under 35 U.S.C. §103(a) as being unpatentable over Szviatovszki in view of Shabtay. Regarding claim 23, the Examiner asserts that Szviatovszki discloses, if a length of the second shortest path is equivalent to a length of the first shortest path, attempting to create a connection on the second shortest path (col. 12, lines 37-43).

The Examiner acknowledges Szviatovszki does not disclose, but asserts that Shabtay discloses that, if a length of the second shortest path is not equivalent to a length of the first shortest path, performing the following steps (col. 5, lines 18-19; col. 4, lines 14-21; col. 5, lines 12-22; and col. 4, lines 35-42 and 61-67): pruning edges not having a second available bandwidth from the first pruned network, thereby creating a second pruned network (col. 5, lines 19-22); computing a third shortest path between the source node and destination node using the second pruned network (col. 5, lines 19-22); and attempting to create a connection on the third shortest path (col. 5, lines 19-22). The Examiner previously asserted that “the length information is provided by OSPF protocol, or that it is combined by bandwidth availability information of the links to utilize rerouting mechanism.” In the Response to Arguments section of the final Office Action, the Examiner asserts that the length information is considered as the length of a path as being smaller or smallest. The Examiner asserts that Applicant should clarify what the length information represents in the claim and should explain the differences between the Shortest Path and the length information. In the Advisory Action, the Examiner asserts that the argument regarding length information is traversed since Hameleers et al. relate OSPF with length information (paragraph [0048]).

Appellants note that the word “length” is defined as “the longest extent of anything as measured from end to end.” (See, dictionary.com.) In the text cited by the Examiner, Szviatovszki teaches that, “if two paths have different, highest-affected priority levels, the path with the lower priority level is chosen. But if the affected priority levels are the same, *the ‘smaller’ path is selected with the lowest pre-empted bandwidth on the highest affected priority level.*” (Col. 12, lines 37-43; emphasis added.) Contary to the Examiner’s assertion, Szviatovszki does *not* disclose or suggest length information; Szviatovszki discloses priority levels and pre-empted bandwidth. Also, contrary to the Examiner’s assertion, Appellants could find *no* disclosure or suggestion of *length information* in Shabtay. Appellants also find no disclosure or suggestion that the length information is provided by the OSPF protocol, or that it is combined by bandwidth availability information of the links to utilize a rerouting mechanism.

Regarding the Examiner’s assertion that the argument regarding length information is traversed since Hameleers et al. relate OSPF with length information, Appellants note that Hameleers et al. was not used in the rejection of any claims and find no record of

Hameleers et al. in the prosecution. Appellants also note that Hameller's teaching that OSPF supports distance metrics does *not* infer that a length of a second shortest path is computed and does *not* infer that a length of a second shortest path is used to determine if an attempt is made to create a connection on the second shortest path, or is used to determine if the following steps are performed:

pruning edges not having a second available bandwidth from the first pruned network, thereby creating a second pruned network;

computing a third shortest path between the source node and destination node using the second pruned network; and

attempting to create a connection on the third shortest path.

Thus, Szviatovszki and Shabtay, alone or in combination, do not disclose or suggest a length of a second shortest path, and do not disclose or suggest computing a second shortest path between the source node and the destination node using the first pruned network; if a length of the second shortest path is equivalent to a length of the first shortest path, attempting to create a connection on the second shortest path; and if a length of the second shortest path is not equivalent to a length of the first shortest path, performing the following steps:

pruning edges not having a second available bandwidth from the first pruned network, thereby creating a second pruned network;

computing a third shortest path between the source node and destination node using the second pruned network; and

attempting to create a connection on the third shortest path, as required by independent claim 23.

Claim 7

Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Devi in view of Aukia, and further in view of Szviatovszki. In particular, the Examiner asserts that Szviatovszki discloses:

when the designed load between the source node and the destination node is greater than a measured load between the source node and the destination node, pruning edges that do not have a first available bandwidth from the network, thereby creating a first pruned network (col. 9, lines 59-67); and

when the designed load between the source and a destination is not greater than a measured load between the source and destination, pruning edges that do not have a second available bandwidth from the network, thereby creating a first pruned network (col. 9, lines 59-67; and col. 10, lines 29-38).

Appellants note that, in the text cited by the Examiner, Szviatovszki teaches:

For this LSP path calculation, the traffic engineering path selection module 72 marks all links in its database 74 as "invalid" having *an unreserved bandwidth at the priority level of the LSP setup priority that is less than the LSP's bandwidth requirement*. This can be determined as a simple inequality comparison $B_{us} < B_{LPS}$. In other words, links are eliminated or "pruned" that do not have enough unreserved bandwidth to support the LSP with the given priority s. (Col. 9, lines 59-67; emphasis added.)

Szviatovszki teaches *an unreserved bandwidth and a bandwidth requirement*; Szviatovszki does *not* disclose or suggest a measured load, does *not* disclose or suggest a designed load, does *not* disclose or suggest that, *when the designed load between the source node and the destination node is greater than a measured load between the source node and the destination node, pruning edges that do not have a first available bandwidth from the network, thereby creating a first pruned network*, and does *not* disclose or suggest that, *when the designed load between the source and a destination is not greater than a measured load between the source and destination, pruning edges that do not have a second available bandwidth from the network, thereby creating a first pruned network*.

Thus, Devi, Aukia, and Szviatovszki, alone or in combination, do not disclose or suggest determining whether a designed load between the source node and a destination node is greater than a measured load between the source and destination nodes; when the designed load between the source node and the destination node is greater than a measured load between the source node and the destination node, pruning edges that do not have a first available bandwidth from the network, thereby creating a first pruned network; and when the designed load between the source and a destination is not greater than a measured load between the source and destination, pruning edges that do not have a second available bandwidth from the network, thereby creating a first pruned network, as required by claim 7.

Conclusion

The rejections of the cited claims under section 103 in view of Devi, Aukia, Szviatovszki, and Shabtay, alone or in any combination, are therefore believed to be improper and should be withdrawn. The remaining rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

Respectfully,

/Kevin M. Mason/

Date: August 3, 2009

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APPENDIX

1. A method for traffic engineering in a network-based communication system, the method comprising the steps of:

5 determining, in response to a request, whether any path of a plurality of predetermined paths between a source node and a destination node meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing a carried demand on a network using at least traffic demand estimates; and network topology information, and by performing routing for the
10 substantially maximized carried demand; and

selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting the at least one requirement is found.

15 2. The method of claim 1, wherein the carried demand comprises a total amount of demand that can be carried in the network.

20 3. The method of claim 1, wherein the at least one requirement comprises a destination address and a bandwidth.

4. The method of claim 1, further comprising the steps of:
determining the traffic demand estimates based at least in part on previously measured traffic demands or historical traffic demands; and
determining network topology by using information from link-state routing.

25 5. The method of claim 1, further comprising the steps of:
substantially maximizing the carried demand using at least the traffic demand estimates and the network topology;

performing routing for the substantially maximized carried demand, thereby
30 determining a plurality of resultant paths; and

storing the plurality of resultant paths as the predetermined paths.

6. The method of claim 1, further comprising the step of:

refusing the connection request if there are no paths in the plurality of predetermined paths meeting the at least one requirement or when the connection utilizing the given path is unavailable.

5

7. The method of claim 1, wherein:

the network topology comprises nodes interconnected through edges;

the request is made by a source node;

the method further comprises the steps of:

10 determining whether a designed load between the source node and a destination node is greater than a measured load between the source and destination nodes;

when the designed load between the source node and the destination node is greater than a measured load between the source node and the destination node, pruning edges that do not have a first available bandwidth from the network, thereby creating a first pruned
15 network; and

when the designed load between the source and a destination is not greater than a measured load between the source and destination, pruning edges that do not have a second available bandwidth from the network, thereby creating a first pruned network.

20 8. The method of claim 7, wherein the first bandwidth is zero and the second bandwidth is a predetermined trunk reservation.

9. The method of claim 7, wherein:

25 the steps of determining whether a designed load, pruning edges that do not have a first available bandwidth from the network, and pruning edges that do not have a second available bandwidth from the network are performed prior to the step of determining, in response to a request, whether any path of a plurality of paths meets at least one requirement; and

the method further comprises performing, if a given path meeting the at least one requirement is not found, the following steps:

30 pruning edges that do not have a first available bandwidth from the

first pruned network to create a second pruned network;
computing shortest path from the source node to the destination
node in the second pruned network; and
attempting to create a connection on the shortest path.

5

10. The method of claim 5, wherein:

the step of maximizing further comprises the steps of:

obtaining a threshold that maximizes a number of connections that
can be accepted; and

10 adjusting traffic demand for each of a plurality of node pairs in the
network until the carried demand is substantially maximized; and

the step of performing routing further comprises the step of minimizing a total
bandwidth-length product subject to a plurality of constraints including edge capacity constraints
and path-assignment constraints.

15

11. The method of claim 5, wherein the step of maximizing further comprises the
step of maximizing the carried demand using at least traffic demand estimates and a graph of the
network, subject to a plurality of first constraints.

20 12. The method of claim 11, wherein the plurality of first constraints comprise:
(1) demand assigned to all paths for a selected node pair is greater than or equal to a demand
corresponding to the selected node pair multiplied by a number to be maximized; (2) demand
assigned to all paths traversing a selected edge is less than or equal to a capacity of the selected
edge; (3) the demand assigned to a path is greater than or equal to zero; and (4) the number to be
25 maximized is between zero and one.

13. The method of claim 5, wherein the step of performing routing further
comprises the step of performing routing for the substantially maximized carried demand,
subject to a plurality of second constraints.

30

14. The method of claim 13, wherein the plurality of second constraints comprise:
(1) demand assigned to all paths for a selected node pair is greater than or equal to a demand corresponding to the selected node pair multiplied by a number to be maximized; (2) demand assigned to all paths traversing a selected edge is less than or equal to a bandwidth used by the selected edge; (3) the bandwidth used by a selected edge is less than or equal to a capacity of the selected edge; and (4) the demand assigned to a path is greater than or equal to zero.

15. The method of claim 5, wherein the step of maximizing comprises the step of maximizing a product of an expectation of a real number to be maximized and a demand, subject to having a mean provisioned demand exceed an offered load with a predetermined probability.

16. The method of claim 5, wherein the step of performing routing further comprises the step of minimizing a total bandwidth-length product subject to a plurality of constraints including path-assignment constraints.

17. The method of claim 16, where the path-assignment constraints comprise constraining a sum of an amount of demand in units of path capacity to be greater than a product of a threshold and a sum of an average demand and a product of a number indicating a distance from a standard deviation and a standard deviation of a normal distribution function.

18. The method of claim 5, wherein the step of performing routing further comprises the step of minimizing a total bandwidth-length product subject to a plurality of constraints, where the plurality of constraints include constraining end-to-end blocking probability for a node pair to be less than a predetermined amount.

19. The method of claim 5, wherein the step of performing routing further comprises the step of determining a threshold minimum capacity assigned for a node pair that will meet a given blocking probability.

20. The method of claim 5, wherein the step of performing routing further comprises the step of minimizing a total bandwidth-length product subject to a plurality of constraints including edge capacity constraints for which demand per node pair is assigned a threshold capacity.

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21. An apparatus for traffic engineering for in a network-based communication system, the apparatus comprising:

a memory; and

at least one processor, coupled to the memory;

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the apparatus operative:

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to determine, in response to a request, whether any path of a plurality of predetermined paths between a source node and a destination node meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing carried demand on a network using at least traffic demand estimates and network topology information, and by performing routing for the substantially maximized carried demand; and

to select one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting the at least one requirement is found.

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22. An article of manufacture for traffic engineering in a network-based communication system, the article of manufacture comprising:

a machine readable medium containing one or more programs which when executed implement the steps of:

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determining, in response to a request, whether any path of a plurality of predetermined paths between a source node and a destination node meets at least one requirement corresponding to the request, wherein the plurality of predetermined paths are determined by substantially maximizing carried demand on a network using at least traffic demand estimates; and network topology information, and by performing routing for the substantially maximized demand; and

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selecting one of said predetermined paths based on a current load measurement, wherein said current load measurement is measured at said source node, if a given path meeting the at least one requirement is found.

- 5 23. A method for traffic engineering for a network-based communication system comprising a network having nodes interconnected through edges, and wherein a source node requests a connection to a destination node, the method comprising the steps of:
- determining a first shortest path between the source node and destination node;
- pruning edges not having a first available bandwidth from the network, thereby
- 10 creating a first pruned network;
- computing a second shortest path between the source node and the destination node using the first pruned network;
- if a length of the second shortest path is equivalent to a length of the first shortest path, attempting to create a connection on the second shortest path; and
- 15 if a length of the second shortest path is not equivalent to a length of the first shortest path, performing the following steps:
- pruning edges not having a second available bandwidth from the first pruned network, thereby creating a second pruned network;
- computing a third shortest path between the source node and
- 20 destination node using the second pruned network; and
- attempting to create a connection on the third shortest path.

24. The method of claim 1, further comprising the step of dynamically determining a path between the source node and the destination node if none of said plurality of
- 25 predetermined paths meet the at least one requirement, wherein said dynamic path is determined at the source node.

EVIDENCE APPENDIX

There is no evidence submitted pursuant to § 1.130, 1.131, or 1.132 or entered by the Examiner and relied upon by appellant.

RELATED PROCEEDINGS APPENDIX

There are no known decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of 37 CFR 41.37.